

A POWERED SOIL TILLAGE DEVICE

Your Petitioners, LAWRENCE J. ZACH, a citizen of the United States and a resident of the State of Nebraska, whose post office address is 3453 18th Avenue, Columbus, Nebraska 68601, and ALOIS J. KOSCH, a citizen of the United States and a resident of the State of Nebraska, whose post office address is 307 Pershing Road, Columbus, Nebraska 68601, pray that Letters Patent may be granted to them for the invention set forth in the following specification:

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

This invention relates to a powered soil tillage device, and more particularly to a lightweight, hand-held powered soil tillage device. More specifically, the powered soil tillage device of this invention is used to cultivate soil in preparation for seeding or planting, for loosening and aeration of soil to benefit plant development, and for the removal of weeds or unwanted vegetation in gardens, fields or similar plots.

2. DESCRIPTION OF THE RELATED ART

Various methods have been used for tilling or cultivating the soil, including manually operated hoes, spades, shovels, rakes and similar devices, which are labor-intensive and time-consuming.

Various powered tillage devices employ rotary tillage members, often disc-shaped with serrated teeth or tine-like protrusions. These machines or devices are commonly known as rototillers and present safety hazards as the rotating discs, blades or tines can cause significant injury if contact occurs with the machine operator, other

1 people, pets, etc. The rotary motion of the tillage members can also snag and entangle
clothing, which can also lead to injury. During operation, devices of this type may lurch
forward, causing unsafe and difficult operation, especially when the rotating tillage
members strike plant roots, rocks or other objects, or when the soil conditions are
5 inconsistent with hard and soft zones. To reduce this condition, some rototillers utilize
powered drive wheels or tracks to propel the machine forward.

Rotary tillage machines cannot be easily maneuvered or guided around or
between individual plants, obstacles or garden plot contours due to the drive wheel-like
10 pulling or grabbing action of the rotating tillage members as they move through the soil.
As such, these machines are normally restricted to cultivating between rows of plants or
where straight-line motion is possible for some distance. Rototiller-type machines also
tend to entangle weeds, vines, etc. as they snag and wrap such materials around the
rotating tillage members, requiring stoppage of the machine and manual clearing of the
15 debris.

Another form of tillage or cultivation often associated with farms, and to a lesser
extent, garden plots, is to pull or push blades, discs or tines through the soil while
submerged or partially submerged in the soil. This movement can be performed
20 manually or by utilizing tractors or similar power sources as the propelling force. Such
devices do not till or churn in the soil as thoroughly as other means and generally are
better suited for larger fields or areas where maneuverability and ease of steering is of
limited importance.

1 Other tillage-powered devices consist of blades or clam-like shovels that open
and close or penetrate and twist the soil. These devices tend to be complex and in
general provide limited soil cultivation effectiveness, and their use is not widespread.

5 SUMMARY OF THE INVENTION

5 A hand-held, powered soil tillage device of lightweight design is described and
includes an elongated hollow support member having upper and lower ends, with a
handle being provided on the upper end of the support member. A power means, such
as an electric motor or internal combustion engine, is mounted on the upper end of the
10 hollow support member and has a power shaft extending downwardly therefrom through
the interior of the hollow support member. A gearbox is mounted on the lower end of
the hollow support member and has a spur gear in mesh with a worm gear which is
mounted on the lower end of the power shaft. The spur gear is mounted on a drive
15 shaft for rotation therewith with the ends of the drive shaft extending outwardly from
opposite sides of the gearbox housing. A first crank arm is secured to one end of the
drive shaft, and a second crank arm is secured to the other end of the drive shaft. The
first and second crank arms are offset 180 degrees with respect to one another. First
and second elongated beams are pivotably secured, intermediate their lengths, to the
20 crank arms, respectively. The upper ends of the first and second beams are secured to
rocker arms which are pivotably connected to a support secured to the hollow support
member above the gearbox. Hoe blades are secured to the forward or lower ends of
the first and second beams, respectively, and are positioned thereon in a transverse
25 relationship with respect to the longitudinal axes thereof.

1 As the power means rotates the power shaft, the power shaft rotates the worm
gear, which in turn rotates the spur gear to cause the first and second crank arms to
rotate. As the offset crank arms rotate, one beam is moving forward and/or upward
5 while the other beam is moving backward and/or downward such that when one blade is
entering the soil, the other blade located behind it (or in front of it, depending on the
machine set-up) is exiting the soil. During operation, one blade moves up and over the
other blade creating a nearly constant hoeing action which minimizes impact jarring and
twisting action to provide full coverage of the zone being tilled to assure severance of
10 weed roots and the like.

It is therefore a principal object of the invention to provide an improved powered
soil tillage device.

15 Still another object of the invention is to provide a hand-held, powered soil tillage
device which is lightweight and which is easily handled.

Still another object of the invention is to provide a powered soil tillage device
which specifically causes the hoe blades to penetrate the soil in a manner to till the
same.

20 A further object of the invention is to provide a powered soil tillage device which
may be either driven by an electric motor or an internal combustion engine.

Still another object of the invention is to provide a powered soil tillage device
wherein the ground-engaging members may comprise hoe blades, spikes, etc.

25 A further object of the invention is to provide a powered soil tillage device which
is highly maneuverable.

1 Still another object of the invention is to provide a powered soil tillage device which is easily operated around and between individual plants, obstacles and confined or contoured spaces.

5 Still another object of the invention is to provide a powered soil tillage device which reduces the tendency to entangle vines, weeds and the like.

 Still another object of the invention is to provide a powered soil tillage device which provides the same effective soil penetrating-slicing-churning-lifting action as a manually-operated garden hoe without the manual effort associated therewith.

10 Still another object of the invention is to provide a powered soil tillage device which is safe to use.

 These and other objects will be obvious to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Figure 1 is a perspective view of the tillage device of this invention;

 Figure 2 is a perspective view of the lower portion of the tillage device of this invention;

 Figure 3 is an exploded perspective view of the lower portion of the tillage device of this invention;

20 Figure 4 is a side elevational view of the lower portion of the tillage device of this invention; and

 Figure 5 is a partial sectional view of the gearbox of the tillage device of this invention.

1 DESCRIPTION OF THE PREFERRED EMBODIMENT

5 The powered soil tillage device of this invention is referred to generally by the reference numeral 10. The tillage device 10 of this invention is designed to be lightweight so as to be hand-held. The tillage device 10 includes an elongated hollow support member 12 having upper and lower ends. A handle 14 is secured to the support member 12 intermediate the ends thereof to enable a person to grasp the same with one hand. A handle 16 is secured to the upper end of the support member 12 and is of conventional design. A power means 18 is secured to the handle 16 in conventional fashion and may comprise an electric motor or an internal combustion engine. Further, the electric motor may be battery-operated if desired. The upper end of a power shaft 20, which is normally flexible, is secured to the power means and is driven thereby. The power shaft 20 extends downwardly through the interior of support member 12 to the lower end of the support member in conventional fashion. To this point, the structure described is that found on a Craftsman® Weedwacker® line trimmer. Applicant has removed the line trimmer apparatus normally found on the lower end of the Craftsman® device and substituted the soil tillage assembly of this invention.

15 Although the preferred embodiment of the invention includes structure as set forth immediately above, the power means 18 may be located at any location on the device. Further, the support member 12 need not necessarily be hollow since the power shaft 20 could be located at the exterior surface of the support member 12. Additionally, the power means 18 could be belt connected or chain connected to the

1 tillage devices located at the lower end of the support member as will be described hereinafter.

5 The numeral 22 refers to the soil tillage assembly which is mounted on the lower end of the support member 12 as will now be described. Assembly 22 includes an L-shaped gearbox housing 24, including a first housing portion 26 and a second housing portion 28 which extends upwardly from the lower end of the first housing portion 26. Although the gearbox housing 24 is shown to be L-shaped, the housing could take other shapes as well.

10 A worm gear 30 is rotatably mounted within housing portion 26 and is secured to the lower end of the power shaft 20 for rotation therewith. The worm gear 30 is in mesh with a spur gear 32 rotatably mounted within gearbox housing 24 and which has a drive shaft 34 extending therethrough and secured thereto for rotation therewith. For purposes of description, the gearbox housing 24 will be described as having opposite sides 36 and 38. One end of drive shaft 34 rotatably extends outwardly through side 36 of housing 24 with the other end of the drive shaft 34 extending outwardly through side 38 of housing 24. One end of crank arm 40 is secured to one end of the drive shaft 34 outwardly of side 36 of housing 24. One end of crank arm 42 is secured to the other end of drive shaft 34 outwardly of side 38 of housing 24. The crank arms 40 and 42 are offset 180 degrees from one another, as seen in the drawings.

25 The numerals 44 and 46 refer to elongated beams positioned on opposite sides of the housing 24. Beam 44 is rotatably connected to crank arm 40 by pin or shaft 48. Beam 46 is pivotably connected to crank arm 42 by means of a pin or shaft 50. The

1 rearward ends of beams 44 and 46 are pivotably connected to the lower ends of rocker
arms 52 and 54, respectively, by bolts or pins 56 and 58, respectively. The other ends
of the rocker arms 52 and 54 are rotatably connected to a support 60, at 53 and 55
5 respectively, which is secured to the support member 12 above gearbox housing 24 as
seen in the drawings. Hoe blades 62 and 64 are selectively removably secured to the
lower or forward ends of the beams 44 and 46, respectively, as seen in the drawings.
Preferably, the hoe blades 62 and 64 are constructed of a hardened high carbon-steel
material. As seen in the drawings, the hoe blade 62 extends inwardly from the lower or
10 forward end of the beam 44, and the hoe blade 64 extends inwardly from the lower or
forward end of beam 46 so that the hoe blades 62 and 64 are positioned in a nearly
identical center-line position, one to the other in a fore and aft position, or one behind
the other. Although the devices are shown as including hoe blades 62 and 64, the
15 preferred hoe blades could be replaced by spikes or other devices if different tillage
operations are required to be performed.

When the power means 18 is energized, the power shaft 20 is rotated to cause
spur gear 32 to rotate, which in turn rotates drive shaft 34. Drive shaft 34 causes crank
arms 40 and 42 to be rotated so that the crank arms swing through a circular path,
20 which in turn drives the beams 44 and 46 in a circular motion at their connection point.
With one end of the beam attached to the rocker arm, and the crank arm propelling the
beam between the ends, the hoe blade is driven in a pattern that is very similar to the
working end of a manual hoe. Each crank arm is 180 degrees offset from the other
25 crank arm such that when one crank arm extends upwardly, the other extends

1 downwardly, and so on. Since the crank arms are 180 degrees offset from one another,
one beam is moving forward and/or upward, while the other is moving backward and/or
downward such that when one hoe blade is entering the soil, the other, located behind it
(or in front of it, depending on the machine's setup), is exiting the soil. The hoe blades
5 are attached perpendicular to the beams such that the blades are essentially parallel
with each other. During operation, one hoe blade moves up and over the other,
creating a nearly constant hoeing action and providing full coverage of the zone being
tilled to assure severance of weed roots and the like.

10 The preferred embodiment of the invention includes the structure as set forth
immediately above. However, the tillage members could be driven by means other than
a worm gear and spur gear enclosing within a housing 24. For example, the beams 44
and 46 could be driven by a chain drive, a belt drive, etc. Additionally, the beams could
15 be reciprocated by structure other than that shown and described. For example, the
rocker arms 52 and 54 could be replaced with a different reciprocating means such as a
slide mechanism, etc.

The tillage device of this invention is lightweight and is easily handled. The
device is highly maneuverable and may be easily moved between plants in an irregular
20 pattern to conform to contoured areas.

Thus it can be seen that the invention accomplishes at least all of its stated
objectives.